



CRS Report for Congress

Homeland Security: Unmanned Aerial Vehicles and Border Surveillance

Christopher Bolkcom
Foreign Affairs, Defense, and Trade Division
Blas Nuñez-Neto
Domestic and Social Policy Division

Summary

Congress has expressed a great deal of interest in using Unmanned Aerial Vehicles (UAVs) to surveil the United States' international land border. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress. This report will be updated as events warrant.

Background

Within the Department of Homeland Security (DHS), Customs and Border Protection (CBP) is the lead agency charged with securing our nation's borders. While CBP is charged with overall border enforcement, within the bureau a distinction is made concerning border enforcement *at* and *between* ports of entry (POE). *At POE*, CBP officers are responsible for conducting immigrations, customs, and agricultural inspections on individuals presenting themselves for entry into the United States. *Between POE*, the United States Border Patrol (USBP) is charged with detecting and preventing the entry of terrorists, weapons of mass destruction, and unauthorized aliens into the country, and interdicting drug smugglers and other criminals.

The USBP utilizes advanced technology to augment its agents' ability to patrol the border. The technologies used include, but are not limited to, sensors, light towers, mobile night vision scopes, remote video surveillance systems, directional listening devices, various database systems, and unmanned aerial vehicles (UAVs). These so-called "force multipliers" allow the USBP to deploy fewer agents in a specific area while maintaining the ability to detect and counter intrusions and are increasingly becoming a part of the USBP's day-to-day operations. Increasingly, DHS has explored the use of UAVs to augment USBP agents' ability to patrol the border. There are two different types of UAVs: drones and remotely piloted vehicles (RPVs). Both drones and RPVs are pilotless, but drones are programmed for autonomous flight. RPVs are actively flown — remotely — by a ground control operator. UAVs are defined as a powered aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 13 MAY 2008		2. REPORT TYPE		3. DATES COVERED 00-00-2008 to 00-00-2008	
4. TITLE AND SUBTITLE Homeland Security: Unmanned Aerial Vehicles and Border Surveillance				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Congressional Research Service, The Library of Congress, 101 Independence Ave, SE, Washington, DC, 20540-7500				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 6	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

lethal or nonlethal payloads.¹ UAVs have played key roles in recent conflicts.² Historically, UAVs have been used in various military settings outside of U.S. borders. UAVs have provided reconnaissance, surveillance, target acquisition, search and rescue, and battle damage assessments. In the recent wars in Afghanistan and Iraq, UAVs have been used for surveillance purposes and to attack enemies. The Predator UAV, for example, was armed with anti-tank weapons to attack Taliban and Al Qaeda members.

UAVs have also been used in domestic settings. The NASA-sponsored Environmental Research Aircraft and Sensor Technology (ERAST) program has produced civilian UAVs to monitor pollution and measure ozone levels. The Massachusetts Institute of Technology (MIT) is involved in developing Global Positioning Systems (GPS) and video camera guidance for using UAVs to locate and identify toxic substances.³ Lastly, the Department of Energy recently announced that it will test UAVs outfitted with radiation sensors to detect potential nuclear reactor accidents.⁴

Congressional Mandates for the Use of UAVs

Congress has directed DHS to study the feasibility of using UAVs and to implement the technology to surveil the border on numerous occasions. In the 108th Congress, the Intelligence Reform and Terrorism Prevention Act (P.L. 108-458) included provisions calling for a pilot program to study the use of these technologies, including UAVs, along the northern border. The law also required DHS to present a plan within six months of enactment to comprehensively monitor the southwest border with UAVs, and to implement the plan as a pilot program as soon as funds are appropriated for that purpose.⁵ The 2003 DOD Authorization Act (P.L. 108-136) required the President to issue a report “on the use of unmanned aerial vehicles for support of homeland security missions.” In the 109th Congress, the conference report to the FY2007 DHS Appropriations Act (P.L. 109-295) urged DHS to work with the Federal Aviation Administration (FAA) to implement a pilot program for the use of UAVs to surveil the northern border.⁶

The FY2006 DHS Appropriations Act (P.L. 108-90) provided \$35.2 million to establish a Northern Border airwing and tasked the DHS Under Secretary of Border and Transportation Security to devise a report outlining operational plans by which the Air and Marine Operations Center (AMOC) would eliminate surveillance gaps affecting the northern border and western United States. The act also provided \$10 million for the use

¹ United States Department of Defense, *Dictionary of Military and Associated Terms*, Joint Publication 1-02, April 12, 2001, p. 557.

² See CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*, by Harlan Greer and Christopher Bolkom.

³ Hugh McDaid, *Smart Weapons* (New York: Barnes and Nobles Books, 1997), p. 9.

⁴ Jefferson Morris, “GoldenEye UAV to perform flight demo for DOE,” *Aerospace Daily*, December 5, 2003.

⁵ P.L. 108-458, sec. 5101-5104 and sec. 5201.

⁶ U.S. Congress, Conference Committees, *Making Appropriations for the Department of Homeland Security for the Fiscal Year Ending September 30, 2007, and for Other Purposes*, 109th Cong., 2nd sess., H.Rept. 109-699, p. 131.

of UAVs. P.L. 108-334, the FY2006 Homeland Security Appropriations Act, provided another \$10 million for UAVs in border security. P.L. 109-295 provided \$20 million in FY2007 for DHS's use of UAVs. In response to these congressional mandates, DHS has tested the use of UAVs to surveil the U.S.-Mexican border since June 2004. The UAV demonstrations conducted by various commercial companies at Fort Huachuca and Gila Bend, Arizona, on behalf of CBP have prompted various questions regarding their potential use within the United States that will be addressed subsequently. One UAV model, the Predator B, was used as part of the Arizona Border Control Initiative, a multi-disciplinary initiative that seeks to coordinate federal, state, and local authorities to control the Arizona border,⁷ until it was destroyed in a crash on April 25, 2006.⁸ Congress required DHS to report on its findings related to this crash and other UAV mishaps by January 23, 2007, in the conference report to P.L. 109-295. The FY2008 Consolidated Appropriations Act (P.L. 110-161) directed DHS to explore the use of UAVs in the marine environment in addition to the border, and appropriated \$15 million for DHS's UAV program. Additionally, the DHS conference report to the FY2008 Act directed DHS to work with other federal agencies, including the FAA, to "evaluate the appropriateness of an FAA exemption for small scale" UAV technology.

Benefits and Limitations of UAVs

Benefits. One potential benefit of UAVs is that they could fill a gap in current border surveillance by improving coverage along remote sections of the U.S. borders. Electro-Optical (EO) sensors (cameras) can identify an object the size of a milk carton from an altitude of 60,000 feet.⁹ UAVs also can provide precise and real-time imagery to a ground control operator, who would then disseminate that information so that informed decisions regarding the deployment of border patrol agents can be made quickly. Additionally, the Predator B used along the southern border can fly for more than 30 hours without having to refuel, compared with a helicopter's average flight time of just over 2 hours. The ability of UAVs to loiter for prolonged periods of time has important operational advantages over manned aircraft. The longer flight times of UAVs means that sustained coverage over a previously exposed area may improve border security.

The range of UAVs is a significant asset when compared to border agents on patrol or stationery surveillance equipment. If an illegal border entrant attempts to transit through dense woods or mountainous terrain, UAVs would have a greater chance of tracking the violator with thermal detection sensors than the stationary video equipment which is often used on the borders. It is important to note, however, that rough terrain and dense foliage can degrade the images produced by a UAV's sensory equipment and thus limit their effectiveness at the borders. The extended range and endurance of UAVs may lessen the burdens on human resources at the borders. Also, UAV accidents do not risk the lives of pilots, as do the helicopters that currently patrol U.S. borders.

⁷ Department of Homeland Security, "Fact Sheet: Arizona Border Control Initiative," available at [http://www.dhs.gov/xnews/releases/press_release_0520.shtm].

⁸ Alan Levin, "Crash Stirs Debate on Drone Safety," *USA Today*, August 7, 2006.

⁹ Peter Hardin, "Eyes in the Skies," *Richmond Times-Dispatch*, October 30, 2003, p. F1.

Limitations. Despite potential benefits of using UAVs for homeland security, various problems encountered in the past may hinder UAV implementation on the border. There are concerns regarding the high accident rate of UAVs, which is currently 100 times higher than that of manned aircraft.¹⁰ Because UAV technology is still evolving, there is less redundancy built into the operating system of UAVs than of manned aircraft and until redundant systems are perfected mishap rates are expected to remain high. Additionally, if control systems fail in a manned aircraft, a well-trained pilot is better positioned to find the source of the problem because of his/her physical proximity. If a UAV encountered a similar system failure, or if a UAV landing was attempted during difficult weather conditions, the ground control pilot would be at a disadvantage because he or she is removed from the event. Unlike a manned pilot, the remote pilot would not be able to assess important sensory information such as wind speed.¹¹

Inclement weather conditions can also impinge on a UAV's surveillance capability, especially UAVs equipped with only an E-O camera and Forward Looking Infrared Radar (FLIR), because cloudy conditions and high humidity climates can distort the imagery produced by EO and FLIR equipment. Although the Predator B is operating in the low-humidity environment of the Southwest, the effects of extreme climatic or atmospheric conditions on its sensors reportedly can be mitigated if DHS decides to outfit the Predator B with a synthetic aperture radar (SAR) system¹² and a moving target indicator (MTI) radar. Adding SAR and MTI to the Predator B's platform could significantly enhance its operational capability for border missions. However, adding SAR and MTI to the UAV platform would increase the costs associated with using UAVs on the border.

According to the CBP Inspector General, the costs of operating a UAV are more than double the costs of operating a manned aircraft. This is because UAVs require a significant amount of logistical support and specialized operator and maintenance training. Operating one UAV requires a crew of up to 20 support personnel. Additionally, the use of UAVs has resulted in fewer alien apprehensions per flight hour than the use of manned aircraft.¹³ The high comparative costs of operating a UAV may be offset somewhat by their comparatively lower unit costs. The unit cost of UAVs varies widely, from \$350,000 for the Shadow UAV to \$4.5 million for the Predator.¹⁴ In contrast, the unit cost for manned aircrafts used along the border vary from \$8.6 million for the CBP Blackhawk helicopters to \$36 million for Immigration and Custom Enforcement's P-3 manned aircraft. However, the benefit of the Blackhawk's relative low unit cost is offset by its lack of endurance, given its maximum flight time of 2 hours and 18 minutes.¹⁵

¹⁰ Ibid.

¹¹ Amy Butler, "ACC Officials To Suggest Service Establish Five Predator Squadrons," *Inside the Air Force*, June 7, 2002.

¹² For more information about Synthetic Aperture Radar, see [<http://www.sandia.gov/radar/whatis.html>]. The Predator's SAR can provide images of up to four-inch resolution at a maximum altitude of 40 kilometers in fair weather.

¹³ Department of Homeland Security, Office of the Inspector General, *A Review of Remote Surveillance Technology Along U.S. Land Borders*, OIG-16-15, December 2005.

¹⁴ CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*.

¹⁵ Paul Jackson, *Jane's All the World's Aircraft 2003-2004*, pp. 721-722.

Other Concerns. Lastly, how UAVs could be integrated into civilian airspace within the United States is a fundamental question that would need to be addressed by the Federal Aviation Administration (FAA) and DHS. Integrating UAVs into civilian airspace so that they could operate safely would require not only the creation of regulatory guidelines by the FAA but also technical developments. The FAA requires that all aircraft operating in U.S. airspace have the ability to detect and avoid other aircraft. For UAVs, this has meant that an operator at AMOC must be dedicated to each UAV that is flying.¹⁶ Additionally, the FAA has required that UAV operators be licensed pilots. The FAA currently is working on guidelines for integrating UAVs into the national air space (NAS) and has deployed a representative to AMOC to liaise with DHS on a variety of issues, including the use of UAVs.¹⁷ Although there are no guidelines or regulations for incorporating UAVs into the NAS, the FAA has worked closely with government users of UAV technology in developing a certificate of authority (COA) so NAS can be blocked off for exploratory development or operational testing. A primary concern of the FAA is whether UAVs can operate in already crowded airspace. Before UAVs can be introduced into national airspace, the FAA, DHS, and other relevant users will need to address collision-avoidance, communication, and weather avoidance issues.¹⁸

Issues for Congress

While Congress has demonstrated consistent support for the concept of using UAVs in border security, many questions remain regarding their practical employment.

Costs vs. Benefits. As noted, the cost comparison between UAVs and manned aircraft is complicated. UAVs are less expensive to procure than manned aircraft but may cost more to operate. Thus, the life cycle cost of UAVs could actually be greater than the life cycle cost of manned aircraft. The disparity in operating may be offset by the fact that UAVs can remain in the air more than 10 times longer than the helicopters currently being used by CBP to support the USBP. Further, UAV command and control systems are being developed that can control multiple UAVs simultaneously. When fielded, these new capabilities may change the cost comparison to favor UAVs over manned aircraft.

UAV Effectiveness. The DHS Inspector General noted that UAVs were less effective, in their limited tests, than manned aircraft in supporting the apprehension of unauthorized aliens. In addition, the UAVs were used to assist in the apprehensions of aliens who had already been detected by other means. However, ability of UAVs to maintain position for over 20 hours represents a significant advantage over manned aircraft; in the future, they may be used to actually detect unauthorized entries as opposed to merely supporting apprehensions of aliens already detected. An issue for Congress could entail whether UAVs are an effective tool for securing the border.

¹⁶ From a CRS site visit to the Air and Marine Operations Center, August 2005.

¹⁷ Testimony of Major General Michael Kostelnik, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, March 29, 2006.

¹⁸ In November 2003, the FAA, DOD, NASA, and six companies launched a five-year program to address the safety and technical concerns associated with using UAVs in national airspace.

Lack of Information. Testing UAVs along the border has been limited. A robust program to test multiple UAVs on the borders might ascertain where, how and whether UAVs should be deployed. Larger scale testing would provide an opportunity to evaluate whether limitations of UAVs would hinder their utility on the border. In the past, multiple UAVs piloted in close proximity have experienced interference and loss of control between the UAV and the remote pilot. In many cases, interference led to accidents. A possible issue for Congress could include whether testing should be expanded before any decisions are made regarding the wide-scale use of UAVs along the border.

Coordination with USBP Agents. While UAVs may, in the future, be used to detect unauthorized entries, the fact remains that USBP agents must be deployed to apprehend any aliens thus identified. A possible issue for Congress could entail whether there are enough border patrol resources to investigate all UAV identified targets.

Safety Concerns. The technical capabilities of the UAVs have been tested in a military context, but serious safety and technical issues need to be addressed if the program is to be expanded domestically. Chief among these issues is the FAA's concerns about the NAS and whether UAVs can be safely incorporated into the nation's crowded skies. It is noted that UAVs suffer accident rates up to 100s of time higher than manned aircraft. However, in an effort to support the wars in Afghanistan and Iraq, DOD fielded UAVs such as Predator and Global Hawk before their development programs were complete. Thus, the UAV accident rate might be lower if these systems had been allowed to mature under the full development program.

Implementation Schedule. Currently, the regular use of UAVs in U.S. airspace appears to be slated for the year 2008, in part due to the FAA concerns outlined above.¹⁹ However, other countries, such as Japan and South Korea have, for many years, used UAVs in a variety of civil roles.²⁰ Italy could fly civil UAVs by the end of 2002.²¹ A possible issue for Congress could involve whether U.S. aviation authorities should pursue a more aggressive implementation plan for the use of UAVs.

Possible Alternatives. A possible issue for Congress could include whether there are potential alternatives to using UAVs to surveil the border. Tethered Aerostat Systems (TARS), helium-filled blimps tethered to the ground with a cable that provides power, may offer one alternative. TARS are unmanned and can loiter for much longer periods of time than UAVs. If UAVs are deemed attractive because of low cost, elevated sensor capabilities, and long loiter times, TARS may be studied as a platform that might offer advantages in all three of these areas. However, TARS do not have capability to move and thus could not be used for pursuit purposes.

¹⁹ "Robots, Jets Could Share Airspace By 2008," *Los Angeles Times*, May 21, 2004. Rich Tuttle, "Meeting on UAVs in NAS gets good industry, FAA reviews," *Aerospace Daily*, November 24, 2003.

²⁰ Statement of Christopher Bolkcom, Senate Governmental Affairs Committee, Subcommittee on International Security, Proliferation and Federal Services, June 11, 2002.

²¹ Tom Kongton, "Italy Could Fly UAVs in Civil Air by Year End," *ISR Journal*, June 14, 2004.